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Date: 10 October 2023

Origin: International

Latest date for receipt of comments: 29 November 2023

Project No. 2023/02309

Responsible committee: EPL/501 Electronic Assembly Technology

Interested committees:

Title: BS EN IEC 60068-2-83 Environmental testing

Part 2-83: Tests - Test Tf: Solderability testing of electronic components for surface mounting devices (SMD) by the wetting balance method using solder paste

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For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



91/1910/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 60068-2-83 ED2

DATE OF CIRCULATION:

2023-10-06

CLOSING DATE FOR COMMENTS:

2023-12-29

SUPERSEDES DOCUMENTS:

91/1907/RR

IEC TC 91 : ELECTRONICS ASSEMBLY TECHNOLOGY

SECRETARIAT:

Japan

SECRETARY:

Mr Osamu IKEDA

OF INTEREST TO THE FOLLOWING COMMITTEES:

SC 23J, TC 40, TC 47, SC 47D, SC 48B, TC 51

PROPOSED HORIZONTAL STANDARD:

☐

Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☒ QUALITY ASSURANCE

☐ SAFETY

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TITLE:

Environmental testing - Part 2-83: Tests - Test Tf: Solderability testing of electronic components for surface mounting devices (SMD) by the wetting balance method using solder paste

NOTE FROM TC/SC OFFICERS:

Issuance of RR and CD was agreed at the TC91/WG3 meeting in June 2023.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENVIRONMENTAL TESTING –

**Part 2-83: Tests – Test Tf: Solderability testing
of electronic components for surface mounting devices (SMD)
by the wetting balance method using solder paste**

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- IEC 60068-2-83 has been prepared by IEC technical committee 91: Assembly Technology. It is an International Standard.
- This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.
- This edition includes the following significant technical change with respect to the previous edition:
- a) Revise Clause 5 to align with that in IEC 60068-2-20:2021.

168 The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

169

170 Full information on the voting for its approval can be found in the report on voting indicated in the above
171 table.

172 The language used for the development of this International Standard is English.

173 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance
174 with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at
175 www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in
176 greater detail at www.iec.ch/publications.

177 The committee has decided that the contents of this document will remain unchanged until the stability
178 date indicated on the IEC website under webstore.iec.ch in the data related to the specific document.
179 At this date, the document will be

- 180 • reconfirmed,
- 181 • withdrawn, or
- 182 • revised.

183

ENVIRONMENTAL TESTING –

Part 2-83: Tests – Test Tf: Solderability testing of electronic components for surface mounting devices (SMD) by the wetting balance method using solder paste

1 Scope

This part of IEC 60068 provides methods for comparative investigation of the wettability of the metallic terminations or metallized terminations of SMDs with solder paste.

Data obtained by these methods are not intended to be used as absolute quantitative data for pass – fail purposes.

NOTE Different solderability test methods for SMD are described in IEC 60068-2-58 and IEC 60068-2-69. IEC 60068-2-58 prescribes visual evaluation using solder bath and reflow method, IEC 60068-2-69 prescribes wetting balance evaluation using solder bath and solder globule method.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-20:2021, *Environmental testing – Part 2-20: Tests – Test Ta and Tb: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60068-2-58, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60194-2, *Printed boards design, manufacture and assembly - Vocabulary - Part 2: Common usage in electronic technologies as well as printed board and electronic assembly technologies*

IEC 61190-1-3, *Attachment materials for electronic assembly – Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60068-1, IEC 60068-2-20:2021, IEC 60068-2-58, IEC 60194-2, and IEC 61190-1-3 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

wettability

intrinsic property of the termination material to form an alloy with the solder

Note 1 to entry: Wettability depends on the base metal used to produce the termination or, in the case of a plated termination, the condition and material used to plate the base metal.

[SOURCE: IEC 60068-3-13: 2016, 3.1.3]

3.2**wetting balance method**

method to measure wetting performance and solderability by measuring vertical force (difference with surface tension and buoyancy) to the specimen and recording as a function of time, when the specimen is immersed into molten solder

3.3**zero line**

line extended to the time axis of the force experienced by the specimen as indicated by the test equipment (force sensor) when the specimen is taken out from the molten solder after the end of the measurement

4 Test**4.1 General description**

The specimen is held on a holder suitable to the specimen and is suspended from sensitive balance. The specimen is immersed into solder paste applied onto the test jig plate, then solder paste is heated to melt. The resultant of the vertical forces of buoyancy and surface tension (hereafter, referred to as "acting force") acting upon the immersed specimen by force sensor and converted into a signal which is continuously recorded or monitored as a function of time on recorder.

NOTE The wetting force can be evaluated only for components of the same shape and size. The absolute evaluation is not achieved by this method.

4.2 Test methods

There are three methods as described below. The choice of the method shall be specified in the relevant specification.

- a) Quick heating method: The wettability of electrodes of a component is evaluated while the solder paste is melted in a rapid temperature rise. The specimen is immersed in the solder paste before the temperature rise starts.
- b) Synchronous method: The wettability of electrodes of a component is evaluated while the solder paste is melted due to a rapid temperature rise. The specimen is immersed in the solder paste when the temperature rise starts.
- c) Temperature profile method: Solder paste is melted using a similar temperature profile used in production and the wettability of the electrodes of a component is evaluated.

NOTE 1 This test (Tf) may be applicable to leaded SMD packages. In order to achieve comparable and repeatable results, test Tf should be done on straight leads.

NOTE 2 Solder paste to be used is not specified in this document.

5 Preconditioning

Unless otherwise specified in the detailed specification of the component, the test shall be made on the specimens as received and care shall be taken not to contaminate the specimens by fingers and other items. The specimen may be immersed in organic solvent at room temperature to remove possible contamination such as grease attached to the surface if cleaning is required by the relevant specification. No other method shall be used to clean the specimen. The specimen thus cleaned may be dried in air.

If required by the relevant specification, one of the preconditioning methods prescribed in 4.1.4 of IEC 60068-2-20:2021 may be used.

6 Preparation**6.1 Solder paste**

Use solder paste that has been stored in a sealed container and stored in a dark environment and below 10 °C, avoiding exposure to direct sunlight. Before conducting this test, it is important to prepare the solder paste properly.

271 Expiration date of the solder paste shall be checked before solder paste preparation procedure listed
272 below.

- 273 a) The solder paste shall be allowed to achieve ambient conditions that shall be nominally $25\text{ °C} \pm 5\text{ °C}$
274 and relative humidity of $(50 \pm 10)\%$ for 8 h or in accordance with the manufacturer's data sheet.
- 275 b) Open the supply container(s); remove any internal cover, scrape off paste adhering to the lid(s),
276 internal covers, and the container walls; and add this material to the paste in the supply container(s).
277 Check that the solder paste is not obviously deteriorated nor separated.
- 278 c) Using a spatula, stir the paste gently for 1 min to 2 min to homogenize it; taking care to avoid the
279 introduction of air.
- 280 d) If necessary, gently transfer the paste to a test container of sufficient volume, taking care to avoid
281 the introduction of air. The remaining solder paste taking out from the container, shall be discarded.
282 The remaining solder paste in the supply container shall be stored in the original dark and cool
283 environment.

284 6.2 Test jig plate

285 Test jig plates shall be stored in a sealed container. Immediately prior to their use, they shall be cleaned
286 using acid such as dilute hydrochloric acid. A new test jig plate shall be used for each test. Unused test
287 jig plates shall be discarded and not be returned to the sealed container.

288 6.3 Specimen holder

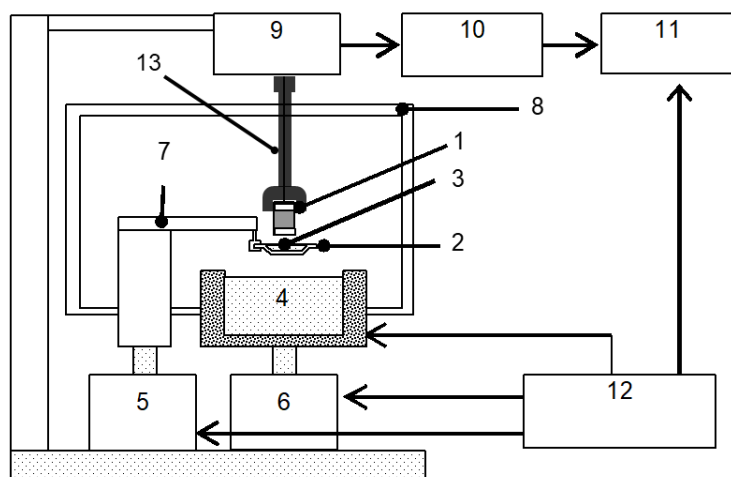
289 The specimen holder is usually contaminated by creeping of flux used in a test. A specimen holder shall
290 be cleaned using a neutral organic solvent. It is desirable to use ultrasonic agitation in cleaning.

291 7 Quick heating method

292 7.1 Equipment

293 The equipment used for the quick heating method consists of a measurement, heating and lift system,
294 as shown in Figure 1. The detailed requirements to the equipment are specified in Annex A.

- 295 a) The measuring system consists of the force sensor that can measure the force vertically acted on a
296 specimen, signal transducer and a recorder.
- 297 b) The heating system shall be capable of controlling the determined set temperature within $\pm 3\text{ °C}$.
- 298 c) The lift system shall be capable of carrying out immersion and withdrawal of the specimen, as
299 specified in 7.4.3.



IEC 1936/11

301 Key

1 specimen

8 housing

2	test jig plate	9	sensor
3	solder paste	10	transducer
4	heating bath	11	recorder
5	lift for test jig plate	12	controller
6	lift for heating bath	13	specimen holder
7	holding jig of a test jig plate		

Figure 1 – Example of the quick heating method test equipment

7.2 Test jig plate

The test jig plate shall be as specified in Table 1.

Table 1 – Specification of the test jig plate for quick heating and synchronous method

Item	Specification of the test jig
Material	oxygen-free phosphate copper
shape	circular indented pan
dimensions (L , W)	less than 30 mm one the side, or less than a total area of 900 mm ²
thickness (t)	0,3 mm $\pm$ 0,03 mm
drawing diameter (D_1 , D_2)	9 mm to 10 mm at the bottom, 13 mm to 14 mm at the top
drawing depth (h)	0,4 mm $\pm$ 0,04 mm
solder resist diameter (D_3 , D_4)	10 mm $\pm$ 0,02 mm for the inner diameter, over 20 mm for the outer diameter
solder resist thickness	0,035 mm $\pm$ 0,01 mm
warp	$\pm$ 0,05 mm (for the longer side for a rectangular shape)

An example of the test jig plate used in the quick heating and synchronous method is shown in Figure 2.